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The 4th IOPP Seminar : Prof. Wei-jie Fu (付伟杰，大连理工大学) && Prof. Lian-yi He (何联毅，清华大学), Jan. 9-2020, Thursday, 10:00 am && 2:30 pm, Room 9409

Time & Place: Jan. 9, Thursday, 10: 00 am, Room 9409

Speaker: Prof. Wei-jie Fu (付伟杰，大连理工大学)

Title: QCD phase structure at finite temperature and density within the functional renormalization group approach

Abstract:

In this talk I will present the recent studies of the phase structure of QCD for Nf=2 and Nf=2+1 dynamical quark flavours at finite temperature and baryon chemical potential. It emerges dynamically from the underlying fundamental interactions between quarks and gluons. To this end, starting from the perturbative high-energy regime, we systematically integrate-out quantum fluctuations towards low energies by using the functional renormalization group. By dynamically hadronizing the dominant interaction channels responsible for the formation of light mesons and quark condensates, we are able to extract the phase diagram for μB/T⊠6. We find a critical endpoint at (T_CEP,μB_CEP)=(107,635)MeV. The curvature of the phase boundary at small chemical potential is κ=0.0142(2), computed from the renormalized light chiral condensate Δ_{l,R}. Furthermore, we find indications for an inhomogeneous regime in the vicinity and above the chiral transition for μB⊠417 MeV. Where applicable, our results are in very good agreement with the most recent lattice results. We also compare to results from other functional methods and phenomenological freeze-out data. This indicates that a consistent picture of the phase structure at finite baryon chemical potential is beginning to emerge. The systematic uncertainty of our results grows large in the density regime around the critical endpoint and I will discuss necessary improvements of our current approximation towards a quantitatively precise determination of QCD phase diagram.
Ref. Wei-jie Fu, Jan M. Pawlowski, Fabian Rennecke, arXiv:1909.02991 [hep-ph]

Time & Place: Jan. 9, Thursday, 2：30pm, Room 9409

Speaker: Prof. Lian-yi He (何联毅，清华大学)

Title: Theory of Strongly Paired Fermions

Abstract

It is known that a weak attractive interaction in cold fermionic systems leads to Cooper pairing and hence superconductivity/superfluidity, which can be realized in electronic systems, nuclear matter, and dense quark matter. The application of magnetic field tuned Feshbach resonance in ultracold Fermi gases of alkali-metal atoms, i.e., tuning the interatomic interaction strength, opens a new paradigm to study strongly interacting many-body phenomena. The crossover from Bardeen-Cooper-Schrieffer (BCS) superfluid to Bose-Einstein condensate (BEC) in Fermi gases has now been experimentally explored in great detail, leading to a number of new concepts such as unitary Fermi gas and universal equation of state that bring new insights to better understand other strongly interacting systems in nature, such as quark gluon plasma and neutron star matter. In this talk I will introduce the many-body theoretical description of strongly paired fermions and some recent developments in quasi-two-dimensional strongly interacting Fermi gases.